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Potential host range of *Spilosoma dalbergiae* (Moore) n. ssp. (Lepidoptera: Arctiidae) in India

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Abstract. The potential host range of *Spilosoma dalbergiae* (Moore) n. ssp. was determined by measuring feeding damage to pieces cut from leaves of 67 plant species and varieties, and was compared with literature reports of host range of other *Spilosoma* species. These tests indicated that *dalbergiae* is polyphagous, and has both horticultural and agricultural pest potentialities.

Introduction

A number of species of *Spilosoma* are engaged in the defoliation of a large variety of plant species of economic importance in North American, Afro-Asian, and European countries. In the oriental region, *S. obliqua* has been reported to cause serious damage to many crops (Patel, 1944, Anonymous, 1969; Prasad and Premchand, 1980). The taxa *Spilosoma dalbergiae*, *S. todara* and *S. bifascia* have been regarded as synonyms of *obliqua* (Lall, 1964). There are now reasons to believe that *obliqua* and *dalbergiae* are separate species (W. Thomas, personal communication), and in some instances damage attributed to *obliqua* might have been caused by *dalbergiae*.

The feeding behavior of larvae of *S. dalbergiae* n. ssp. is similar to *obliqua*. During early instars (I and II) larvae of *dalbergiae* n. ssp. feed gregariously on the leaf surface and do not move from plant to plant. In their advanced instars they move from plant to plant and from field to field, feeding on many plant species. The larvae may not restrict themselves to a particular habitat in later instars. The damage is done mainly by 3rd to 7th instar larvae, which skeletonize the plant.

There are several records of plants susceptibilities to *S. obliqua*, but most are based on observations of feeding damage. Bhattacharya and Rathore (1977) have published the host list of *S. obliqua* which contains 94 actual or potential hosts. However, host lists based on visual signs of damage provide no data concerning the influence of host plants

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on the feeding behavior of insect (Ladd, 1987). Many researchers have carried out feeding tests to obtain information on these aspects (Kogan and Goeden, 1970; Bhattacharya and Rathore, 1977).

The information on the host range of species can be utilized in the planning of the ecosystem for the establishment of an insect pest management programme. In the majority of ecosystems, agricultural and horticultural crops are surrounded by large tracts of uncultivated land. These areas harbor many plants which constitute a vital part of ecological niche of both pests and beneficial insects. In addition to providing protected sites during adverse conditions, such areas provide food to the insects when the fields are crop-free (Price and Waldbauer, 1982).

The purpose of this study was to determine the range of potential hosts of *S. dalbergiae* n. ssp. so that feeding behavior and pest potentiality could be quantified and susceptibility of ecosystem to it determined.

Materials and Methods

Taxonomy: The adults of *S. dalbergiae* and *S. obliqua* have been described by Hampson (1894) and Ahmad and Ahmad (1976) respectively. A complete description of the adults of this new subspecies will be published by Dr. W. Thomas (West Germany). Nominate *S. dalbergiae* is distributed in Kangra, Sikhim, Kasis and Nagas (Hampson, 1894), this new subspecies has been observed in Kangra and Pantnagar. *We provide here enough information to distinguish the immature stages of the two species.

The egg clusters of *dalbergiae* n. ssp. are not as compact as those of *obliqua*. The newly-hatched larvae of *dalbergiae* n. ssp. are yellowish, and the body is covered with tiny hair. A pink ring on the first abdominal segment, and pink spots on the last three segments, appear on the 2nd day. A dark black band on the first abdominal segment is apparent in the 2nd and 3rd instars, on a ground color of filthy yellow. The 4th, 5th and 6th instars are a dark and dirty yellow and possess a black band on the 1st abdominal segment. The dorsal part of the posterior segment is also black. The color of the 7th instar becomes dark and rusty.

In case of *S. obliqua*, the color of 1st instar is pale yellow and there are no pink bands or spots on the body. The second instar larva becomes yellowish with a greenish tinge, and there is no black band on the 1st abdominal segment. The color further darkens through the fourth instar. The thoracic segments and the three posterior abdominal segments develop a blackish tinge in the 5th instar, which remains until the last instar (Goel and Arun Kumar, 1983). The black band on the 1st abdominal segment of *S. dalbergiae* is not found in *S. obliqua* at any stage.

Culture: Adults were collected in a light trap. Paired insects were held for egg laying in plastic jars (diameter 9 cm; height 10.5 cm), the walls of which were lined with white paper. Adults were provided with a 10 percent sucrose solution soaked in cotton as food. The eggs obtained were kept in petridishes for hatching, and newly emerged larvae were reared under laboratory conditions (temperature: mean T min = 17.3°C; mean T max = 26.3°C; relative-humidity: mean RH min = 58.1% mean RH max = 93.7%) in glass jars (22 × 30 cm). The larvae were reared to fourth or fifth instar on the leaves of cowpea (*Vigna unguiculata* (L.) Walp.), which is known to be a good medium for rearing *S. obliqua*.

Host range test: The experiment was conducted in glass petridishes (12.25 cm diameter), the bottoms of which were filled with a 1 cm thick layer of wax. The surface of the wax was covered with blotting paper. Sixty seven cultivated or wild plant species were selected from various habitats (forest, horticultural, and agro-ecosystem) in Palampur (Himachal Pradesh). Each host was tested simultaneously in two petridishes. Four 1 cm square pieces were cut from the leaves of test plants and were fixed equidistant in the perimeter of each petridish with micro-entomological pins, 3 to 4 mm above the surface of blotting paper, so that larvae could feed freely on them. Before experimentation, the larvae were starved for 20 hours. One larva was released in the center of each petridish and was allowed to feed for two hours. The area of each leaf piece eaten by the larva was estimated using graph paper. Percent feeding on each plant species was calculated by taking the average of the 8 leaf pieces.

Results and Discussion

Feeding varied from 0 to 100 per cent among plant species (Table 1). In our opinion, the plants on which feeding was less than 5 per cent should not be included in the host spectrum of the species, since such low feeding rates may result from test bites by the insect, which may be taken even on non-host plants. So, the plants *D. gyrans*, *C. cajan*, *M. charantia*, *M. cochinchinensis*, *Z. mays*, *S. vulgare*, *L. esculentum*, *O. sativa*, *S. officinarum*, *P. purpureum*, *C. sinensis*, *J. regia*, *C. rotundus*, *C. nobilis* x *C. deliciosa*, *L. chinensis*, *Musa* sp., *C. medica* v. *galgal*, *E. japonica*, *O. europaea*, *M. indica*, *R. religiosa*, and *E. globulus* should not be included in the host list of *S. dalbergiae*.

Significant differences were noticed in the degree of feeding on different varieties of *G. max*; Punjab-1 was eaten more as compared to Bragg and Lee. Other Leguminous crops (i.e., *D. biflorus*, *P. sativum*, *P. vulgaris*, *P. mungo* and *V. unguiculata*) did not show any difference in percent feeding. Among Cucurbitaceous vegetables, *L. cylindrica* and *C. sativus* were eaten appreciably. As compared to other Solana-

Table 1: Host range of *Spilosoma dalbergiae* (Moore) n. ssp.

Test Plant	Family	Percent feeding	Test Plant	Family	Percent feeding
GROUP-1. AGRICULTURAL CROPS			GROUP-2. HORTICULTURAL AND FOREST PLANTS		
Glycine max (Punjab-1)	Leguminosae	97.63± 2.38	*Morus alba*	Moraceae	100.00± 0.00
Luffa cylindrica	Cucurbitaceae	87.50±12.54	*Bauhinia variegata*	Caesalpinoidae	94.88± 5.14
Cucumis sativus	Cucurbitaceae	73.01±21.31	*Prunus persica*	Rosaceae	79.38±16.42
Dolichos biflorus	Leguminosae	61.25±11.28	*Lantana camara*	Verbenaceae	75.00±25.07
Pisum sativum	Leguminosae	50.00± 0.00	*Malus domestica*	Rosaceae	74.25± 0.75
Solanum melongena	Solanaceae	48.50± 1.50	*Fragaria ananassa*	Rosaceae	72.50±11.79
Phaseolus vulgaris	Leguminosae	43.50± 4.50	*P. amygdalus* v. *dulcis*	Rosaceae	64.88± 8.15
Cucurbita pepo	Cucurbitaceae	40.75±13.79	*Salix babylonica*	Salicaceae	57.13±20.94
Phaseolus mungo	Leguminosae	38.25±11.79	*Amomum subulatum*	Zingiberaceae	53.25± 3.26
Brassica campestris v. *sarson*	Cruciferae	35.63±12.91	*Robinia pseudoacacia*	Leguminosae	52.25±47.89
B. oleracea v. *capitata*	Cruciferae	30.00± 5.01	*Ficus carica*	Moraceae	50.00±50.15
Spinacia oleracea	Chenopodiaceae	29.50± 4.51	*Pyrus communis*	Rosaceae	48.25± 0.75
Ricinus communis	Euphorbiaceae	24.63± 5.39	*Lagerstroemia indica*	Melastomaceae	38.00± 9.03
Abelmoschus esculentus	Malvaceae	23.88± 5.39	*Prunus domestica*	Rosaceae	37.63±37.49
Vigna unguiculata	Leguminosae	23.13± 0.63	*Punica granatum*	Myrtaceae	36.13± 1.13
Colocasia esculenta	Araceae	20.88± 2.88	*Rosa indica*	Rosaceae	29.50±29.59
G. max (Lee)	Leguminosae	20.63±20.69	*Populus* sp.	Salicaceae	21.50±21.56
Raphanus sativus	Cruciferae	20.62± 0.63	*Cannabis sativa*	Moraceae	19.25±19.31
G. max (Bragg)	Leguminosae	17.25± 6.27	*Grewia* sp.	Tiliaceae	17.13±16.93
Cajanus cajan	Leguminosae	13.50±13.04	*Carya illinoensis*	Juglandaceae	12.38± 4.64
Amaranthus spinosus	Amaranthaceae	10.00± 4.01	*Psidium guajava*	Myrtaceae	9.75± 9.78
Solanum tuberosum	Solanaceae	9.38± 9.40	*Citrus limon*	Rutaceae	6.63± 0.13
Capsicum sp.	Solanaceae	8.25± 1.50	*Camellia sinensis*	Theaceae	4.63± 1.38
Desmodium gyrans	Leguminosae	3.00± 1.00	*Juglans regia*	Juglandaceae	4.50± 4.51
Capsicum annum	Solanaceae	2.88± 0.13	*C. nobilis* x *C. deliciosa*	Rutaceae	4.00± 0.00
Momordica charantia	Cucurbitaceae	1.00± 1.00	*Litchi chinensis*	Sapindaceae	2.63± 2.63
Mucuna cochinchinensis	Leguminosae	0.12± 0.13	*Musa* sp.	Musaceae	0.75± 0.75
Zea mays	Graminae	0.00± 0.00	*C. medica* v. *galgal*	Rutaceae	0.25± 0.25
Sorghum vulgare	Graminae	0.00± 0.00	*Eriobotrya japonica*	Rosaceae	0.00± 0.00
Lycopersicum esculentum	Solanaceae	0.00± 0.00	*Olea europaea*	Oleaceae	0.00± 0.00
Cyperus rotundus	Cyperaceae	0.00± 0.00	*Mangifera indica*	Anacardiaceae	0.00± 0.00
Oryza sativa	Graminae	0.00± 0.00	*Ficus religiosa*	Moraceae	0.00± 0.00
Saccharum officinarum	Graminae	0.00± 0.00	*Eucalyptus globulus*	Myrtaceae	0.00± 0.00
Pennisetum purpureum	Graminae	0.00± 0.00			

ceous vegetables tested, *S. melongena* was eaten more. No significant difference was seen in feeding among Cruciferous vegetables.

Temperate fruits were consumed more as compared to sub-tropical fruits; however, no significant differences existed among different pome, stone, or nut fruits. Other temperate fruits like *F. ananassa* and *P. granatum* were also eaten appreciably while *O. europaea* was rejected. Percent feeding was very low on all the sub-tropical fruits tested. Appreciable feeding occured on some other plants of this group also. Maximum feeding occured on *M. alba* followed by *B. variegata* and *L. camara.*

Comparison of the host range of different species of *Spilosoma* indicates that various plant species such as *A. esculentus*, *B. campestris* var. *sarson*, *C. cajan*, *C. sativa*, *C. sativus*, *D. biflorus*, *L. camara*, *L. cylindrica*, *P. mungo*, *S. oleracea* and *V. unguiculata* are eaten by both the Oriental species, *obliqua* and *dalbergiae*. *S. dalbergiae* also has some hosts like *C. pepo*, *P. vulgaris*, *P. domestica* and *P. persica* common with the North American species *S. virginica*. *G. max*, *P. sativum*, *R. sativus*, *R. communis*, *S. melongena*, *S. tuberosum*, and *B. oleracea* var. *capitata* are hosts of *S. dalbergiae*, *S. obliqua* and *S. virginica*. *M. alba* has been found to be a host of many *Spilosoma* species, including *dalbergiae*, *obliqua*, *imparilis*, *lubricipeda*, *mori* and *subcarnea* (Maki, 1916; Fenton, 1937; Golanski, 1967; Tietz, 1972; Bhattacharya and Rathore, 1977; Roberts et al., 1977; Hondo, 1981).

S. dalbergiae and *S. obliqua* (Bhattacharya and Rathore, 1977) showed several similarities and differences in their host preference. Both these species rejected *M. charantia*, *M. indica*, *F. religiosa*, *O. sativa* and *S. officinarum*. *S. dalbergiae* ssp. n. accepted the plants *P. granatum*, *S. tuberosum* and *F. carica*, which are rejected by *S. obliqua*. This species rejected *C. rotundus* and *Z. mays*, which are accepted by *S. obliqua*. The plants *C. sativus* and *S. oleracea* were found to be good host plants for both species. Neither species preferred *P. guajava*.

The wide range of acceptable hosts clearly indicates that the new subspecies of *dalbergiae* is polyphagous. The tendency of the insect to feed on temperate fruits (e.g., almond, apple, pear, peach, plum, and strawberry), vegetables (e.g., pumpkin, vegetable sponge, cucumber, brinjal, potato, radish, cabbage, mustard, lady-fingre, and spinach), and legumes (e.g., pea, black gram, French bean and soybean) indicates that the species has both horticultural and agricultural pest potentialities. It also readily accepted many forest and ornamental plants. We cannot rule out the possibility that some of the out-breaks recorded for *obliqua* (Lall, 1964) might have been caused by *dalbergiae*. The tendency of *dalbergiae* to feed on a wide variety of plant species indicates that the insect can be a pest in many ecosystems.

The spectrum of potential host plants of early and advanced instars of larvae may vary. Generally, the spectrum of potential host plants have been found to be wider for early instars than for old larvae (Wiklund,

1973). The host range of this new subspecies indicates that it can survive well in agricultural, forest, or mixed systems. The ability of the species to feed on seasonal, annual, biennial, perennial, herbs, shrubs, or trees indicate its substantial potential as a pest species.

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